CLAIMS

What is claimed is:

1. A method for designing symmetric-sweep spectral-spatial RF pulses comprising the steps of:

a) specifying a pulse duration and gradient oscillation frequency for the RF pulse,

b) designing a beta-polynomial for a spectral dimension of the RF pulse,

c) altering polynomial roots of the spectral linear-phase beta-polynomial as plotted in the complex plane,

d) computing a non-linear phase beta-polynomial using the altered roots, and

e) computing a symmetric sweep beta-polynomial RF pulse from the non-linear phase beta-polynomial.

2. The method as defined by claim 1 wherein step a) determines the number of sub-lobes, the number of beta-polynomial coefficients for the spectral dimension (N), and a time-bandwidth product for the spectral dimension (TB) based on spectral bandwidth and pulse duration.

3. The method as defined by claim 2 wherein step b) uses number of coefficients (N), time-bandwidth product (TB), and weighting factors for in-band and out-of-band ripple optimization.

4. The method as defined by claim 3 wherein step b) uses a Parks-McClellan digital filter design algorithm.

5. The method as defined by claim 4 wherein step c) flips approximately half of the roots of the passband inside the unit circle and flips the other half of the roots of the passband outside of the unit circle.

6. The method as defined by claim 5 wherein in step c) the roots are altered such that one-half of the passband contains roots inside the unit circle, and the other half of the passband contains roots outside the unit circle.

7. The method as defined by claim 4 and further including:

f) repeating steps b) - e) after altering weighting factors in step b) to improve pulse performance.

8. The method as defined by claim 4 and further including:

f) repeating steps b) - e) after changing the root pattern of the spectral beta-polynomial in step c) to improve pulse performance.

9. The method as defined by claim 4 and further including:

f) repeating steps b) - e) after altering pulse duration or gradient oscillation frequency in step a) to improve pulse performance.

10. The method as defined by claim 4 wherein the RF pulse is designed for use in magnetic resonance spectroscopic imaging.

11. The method as defined by claim 10 wherein the RF pulse is designed for use in spatially resolved measurement of metabolite levels.

12. The method as defined by claim 11 wherein the metabolite is lactate.

13. The method as defined by claim 1 wherein the RF pulse is designed for use in magnetic resonance spectroscopic imaging.

14. The method as defined by claim 13 wherein the RF pulse is designed for use in spatially resolved measurement of metabolite levels.

15. The method as defined by claim 14 wherein the metabolite is lactate.